Re Item V

Reasoned statement with regard to novelty, inventive step, and industrial applicability; documents and explanations supporting such statement

1   In the present report, reference is made to the following documents:

D1: DE 198 46 463 A (M&W Bau, D. Friedrich), May 11, 2000 (05/11/00)

D2: US-A-6,011,482 (Buttrick, James, et al.), January 4, 2000 (01/04/00)

D3: US-A-5,216,819 (Givler, Gregory C.), June 8, 1993 (06/08/93)

D4: EP-A-0 820 823 (Bodmer Kuesnacht), January 28, 1998 (01/28/98).

2   INDEPENDENT CLAIM 1

2.1 The present application does not meet the requirements of Article 33(1), PCT because the subject matter of Claim 1 is not novel as defined by Article 33(2), PCT.

Document D1 discloses the following (information in parentheses refers to this document):

Method for connecting components (*see column 1, lines 3 to 7*), whereby at least one rivet (19) penetrates at least one component (20), and a closing head is molded on the rivet or any given molded part by means of a molding machine (*see column 1, line 6*),

wherein prior to the deformation of the closing head on the rivet or the given molded part, a rivet projection (*see column 4, line 61*) is determined (*see column 4, line 57 to column 5, line 8*) for the respective determination of the molding parameters, such as the molding course, molding time, and molding force (*see column 3, lines 16 to 20*),

wherein the rivet projection is calculated in a computing unit (*implicit*) from the measured values from the at least one measuring element (22, 16) (*see column 4, line 57 to column 5, line 8*), and after determining the rivet projection, a

correction factor for the molding process is **recalculated** in the computing unit **for each successive riveting operation** (see <u>alternative to Claim 6, column 2, lines 63 to 68</u>).

3   INDEPENDENT CLAIM 2

3.1   Document D1 is regarded as the most proximate prior art with respect to the subject matter of Claim 2. The cited document discloses the following (information in parentheses refers to this document):

Method for connecting components (*see column 1, lines 3 to 7*), whereby at least one rivet (19) penetrates at least one component (20), and a closing head is molded on the rivet or any given molded part by means of a molding machine (*see column 1, line 6*),

wherein prior to the deformation of the closing head or the given molded part, a rivet projection (*see column 4, line 61*) is determined (*see column 4, line 57 to column 5, line 8*), and deviations of the rivet projection (*actual value*) from an allowable value (*target value*) are automatically compensated for (*adjusted*) (*see column 4, line 57 to column 5, line 65*) by automatic adjustment of the process variables such as molding time or molding course (*see column 3, lines 16 to 20*).

The subject matter of Claim 2 differs therefrom, as follows:

A minimum rivet projection U_{min} or a maximum rivet projection U_{max} [may be] predefined to produce a tolerance range for the rivet projection U, whereby the rivets, for example component pairs, which respectively fall below or exceed the rivet projection U_{min} or U_{max} are excluded as rejects.

The subject matter of Claim 2 is therefore novel (Article 33(2), PCT).

3.2   The object to be achieved by the present invention may therefore be regarded as achieving consistency in the riveting results within the allowable tolerance range (see Description section of the application, line 6, lines 20 to 21).

The approach proposed for this object in Claim 2 of the present invention is based on inventive step (Article 33(3), PCT) for the following reasons:

A method wherein the deviation of the rivet projection is compensated for by automatic adjustment of the process variables is known from D1.

A method wherein the deviation of the rivet projection outside a tolerance range results in rejection of the rivet is known from D2 through D4.

A method wherein the deviation of the rivet projection within a tolerance range is compensated for by automatic adjustment of the process variables, and outside this tolerance range results in rejection of the rivet, is neither known from the prior art nor made obvious by same.

3.3   Claims 3 through 9, when regarded as dependent on Claim 2, likewise meet the requirements of the PCT with regard to novelty and inventive step.

4   REMARKS

4.1   A new Claim 1 that would incorporate the combination of features from the introductory section of the Description, page 6, second paragraph would likewise neither be known from the prior art (D1) nor made obvious by same.

4.2   Although the independent claims are not written in two-part form, all known features from the prior art (Document D1) taken in combination are included in the preamble (Rule 6.3 b) i), PCT), and the remaining features are included in the characterizing part (Rule 6.3 b) ii), PCT).

4.3 The Description section is not, as required by (Rule 5.1 a) iii), PCT), consistent with the claims; see, for example, the introductory section of the Description, page 3, first paragraph.

The object of the present invention is to improve upon a method of the aforementioned type in which economical rivets can be used and a rivet connection can be produced which results in a perfect and tolerable rivet connection, even when the rivet projection is above or below an allowable value.

DE 193 46 463 A1 discloses a method for controlling a device for shaping a workpiece by use of a tool which may be acted on by pressure, whereby a rivet projection is determined, and the riveting process, in particular the process parameters thereof, may be adjusted based on stored comparison curves for producing a charge.

This object is achieved by the characterizing features of Claims 1 and 2.

In the present invention, it has proven to be particularly advantageous that, for each rivet connection or component pair composed of a rivet and component, a rivet projection on the rivet shaft is precisely determined before the molding process or before deformation. If the rivet projection is within the tolerance range, by use of preselected molding parameters of molding course and molding time the closing head is deformed for a correct rivet connection. However, if the rivet which penetrates the component exceeds the allowable rivet projection, in the method according to the invention compensation is automatically made in the riveting or molding process by determining the actual rivet projection for the respective rivet connection, and the molding course, molding time, and molding force are modified and adjusted so that a perfect riveting operation can still be ensured. The same applies for the opposite case: if the rivet projection actually measured and determined before the molding process is below the minimum limit,

i.e., the minimum rivet projection, this is likewise taken into account in the riveting and the molding parameters such as the molding course and molding time. Preferably, after each rivet projection is determined the molding process is automatically respecified, i.e., the parameters thereof are respecified and adjusted, depending on the deviation from the required rivet projection.

1. Method for connecting components (5), whereby at least one rivet (1)
    penetrates at least one component (5), and a closing head (6) is molded on
    the rivet (1) or any given molded part (1) by means of a molding machine,

    characterized in that

    prior to the deformation of the closing head (6) on the rivet (1) or the given
    molded part (1), a rivet projection (U) is determined for the respective
    determination of the molding parameters, such as the molding course,
    molding time, and molding force, wherein the rivet projection (U) is
    calculated in a computing unit from the measured values from the at least
    one measuring element, and after determining the rivet projection (U), a
    correction factor for the molding process, in particular for the riveting
    process parameters for determining the molding course, molding time, and
    molding force, is recalculated in the computing unit for each successive
    riveting operation.

2. Method for connecting components (5), whereby at least one rivet (1)
    penetrates at least one component (5), and a closing head (6) is molded on
    the rivet (1) or any given molded part (1) by means of a molding machine,
    characterized in that prior to the deformation of the closing head (6) or the
    given molded part (1), the rivet projection (U) is determined, and deviations
    of the rivet projection (U) from an allowable value are automatically

compensated for by automatic adjustment of the process variables such as molding time or molding course, a minimum rivet projection U min or a maximum rivet projection U max being predefined to produce a tolerance range for the rivet projection U, whereby the rivets, for example component pairs, which respectively fall below or exceed the rivet projection Umin or Umax are excluded as rejects.

3.   Method according to Claim 1 or 2, characterized in that to measure the rivet projection, at least one measuring element, in particular two scanning devices, are used, one of the measuring elements being a rivet header or being attached thereto.

4.   Method according to at least one of Claims 1 through 3, characterized in that the rivet projection (U) is calculated by the computing unit in real time.

5.   Method according to at least one of Claims 1 through 4, characterized in that two measuring elements, in particular two scanning devices, are used which are situated on a common measuring axis, these measuring elements being connected to a rivet spindle which supports the rivet header and traverses the riveting stroke.

6.   Method according to at least one of Claims 1 through 5, characterized in that the second measuring element, in particular scanning device, transmits a signal to the computing unit and the measured value is filed and stored on the measuring axis of the first scanning device.

7.   Method according to at least one of Claims 1 through 6, characterized in that for the rivet projection (U) which is determined from two measured values by use of two measuring elements, the same measuring axis need not correspond to the actual dimensions of the workpiece or the value to be ascertained, but, rather, may be offset with respect to the nominal value that is programmed or represented.

8.   Method according to at least one of Claims 1 through 7, characterized in that after the projection (U) of the determined component pair is determined, compensation and adjustment is made for the start of riveting in addition to a molding course and molding time, depending on the change in the rivet projection with respect to the actual value for each riveting operation to be performed.

9.   Method according to at least one of Claims 1 through 8, characterized in that before each molding process, in particular before each riveting process, compensation is automatically made for component pairs, in particular, the determination of the rivet projection, and the process parameters for the riveter and/or molding machine are automatically adjusted with respect to the molding operation to be performed, the molding time, and the molding course, depending on the deviation of the value (X) from the allowable and specified rivet projection (U).